WHAT IS CLAIMED IS:

1. A variable gain optical amplifier, comprising:

an amplifier stage;

a variable optical attenuator connected to said amplifier stage and having a movable controller that changes an attenuation of an amplifier output when moved to a different position; and

a dynamic controller that generates signals indicative of input signal and output signal strength of said amplifier stage;

including gain detecting circuits and a position indicating circuit that provides a signal indicative of a position of the attenuator controller, and

a signal processor connected to said gain detecting circuits that maintains a selected gain setpoint for said amplifier in accordance with said signal input and output strengths and a predetermined relationship between a position of said attenuator controller and signal attenuation.

2. The variable gain optical amplifier described in claim 1, wherein said signal processor is connected to said pump power source of said amplifier stage, and maintains said selected gain setpoint by modulating power from said power source in response to signals from said gain detecting circuits and the position indicating circuit.

3. The variable gain optical amplifier described in claim 1, wherein said signal processor is connected to said attenuator controller, and maintains said selected gain setpoint by adjusting said movable attenuator controller in response to signals received from said gain detecting circuit.

4. The variable gain optical amplifier described in claim 1, wherein said signal processor maintains said selected gain setpoint by means of a preprogrammed formula that correlates a selected gain setpoint with an incoming signal strength, a gain level of said amplifier stage, and a position of said attenuator controller.

5. The variable gain optical amplifier described in claim 1, wherein said signal processor includes a look-up table correlating a selected gain setpoint with input and output signal strengths of said amplifier stage, and a position of said attenuator controller.

6. The variable gain optical amplifier described in claim 1, wherein said amplifier stage includes a length of gain fiber and a source of laser pump light.

7. The variable gain optical amplifier described in claim 6, wherein said gain fiber includes a dopant.

8. The variable gain optical amplifier described in claim 7, wherein said dopant includes a rare earth metal.

9. The variable gain optical amplifier described in claim 2, further comprising a second amplifier stage having an input that is connected to an output of said first stage via said variable optical attenuator, said second amplifier stage having a light pump, and a power source for said pump.

10. The variable gain optical amplifier described in claim 9, wherein said gain detecting circuit includes first and second circuits for sensing signal strength at an input and the output of said first stage, respectively, and a third circuit for sensing an output of said second stage.

11. The variable gain optical amplifier described in claim 10, wherein said signal processor computes an optical signal strength at a point between said attenuator and the input of said second stage from said signal received from said position indicating circuit.

12. The variable gain optical amplifier described in claim 9, further comprising a gain flattening filter coupled between said variable optical attenuator and said second stage input.

13. The variable gain optical amplifier described in claim 10, wherein said first, second, and third circuits of said gain detecting circuit each include optical tap for diverting light from said amplifier to a photodiode that converts said light into an electrical signal.

14. The variable gain optical amplifier described in claim 9, wherein said signal processor is connected to said pump power source of said second amplifier stage and maintains said selected setpoint by modulating power from said second stage power source in response to signals received from said gain detecting circuit.

15. A variable gain optical amplifier, comprising:

first and second amplifier stages, each of which includes an input and an output, a light pump, and a power source for said pump;

a variable optical attenuator connected between the output of said first amplifier stage and the input of the second amplifier stage and having a movable controller that changes an attenuation in optical output when moved to a different position, and

a dynamic controller including:

first and second gain detecting circuits that generate signals indicative of signal gain for said first and second amplifier stages, respectively;

a controller position indicating circuit that provides a signal indicative of a position of the attenuator controller, and

a signal processor connected to said gain detecting and position indicating circuits that maintains a selected gain setpoint for said amplifier in accordance with outputs of said gain detecting circuits and a predetermined relationship between a position of said attenuator controller and signal attenuation.

16. The variable gain optical amplifier described in claim 15, wherein said signal processor is connected to at least one of said pump power sources of said amplifier stages, and maintains said selected gain setpoint by modulating power from

either or both of said power sources in response to signals from said gain detecting circuit.

17. The variable gain optical amplifier described in claim 15, wherein said signal processor is connected to said movable attenuator controller, and maintains said selected gain setpoint by adjusting said movable attenuator controller in response to signals received from said gain detecting circuits and position indicating circuit.

18. The variable gain optical amplifier described in claim 15, wherein said signal processor maintains said selected gain setpoint by means of a preprogrammed formula that correlates a selected gain setpoint with an incoming signal strength, gain levels of said first and second amplifier stages, and a position of said attenuator controller.

19. The variable gain optical amplifier described in claim 15, wherein said signal processor includes a look-up table correlating a selected gain setpoint, gain levels sensed by said first and second gain detecting circuits, and a position of said attenuator controller.

20. The variable gain optical amplifier described in claim 15, wherein said position indication circuit includes a potentiometer.

21. The variable gain optical amplifier described in claim 15, wherein said position indication circuit includes a stepper motor.

22. The variable gain optical amplifier described in claim 15, wherein each amplifier stage includes a length of erbium doped gain fiber, a source of pump light connected to said fiber, and a variable power source connected to said pump light source, wherein said signal processor controls an amount of power transmitted to said pump light via said power source in response to a selected amplifier setpoint.

23. The variable gain optical amplifier described in claim 15, wherein said signal processor computes an optical signal strength at a point between said attenuator

and the input of said second stage from said signal received from said position indicating circuit.

24. The variable gain optical amplifier described in claim 15, further comprising a gain flattening filter coupled between said variable optical attenuator and said second stage input.

25. The variable gain optical amplifier described in claim 15, wherein each of said gain detecting circuits includes an optical tap for diverting light from said amplifier to a photodiode that converts said light into an electrical signal.

26. The variable gain optical amplifier described in claim 25, wherein said first gain detecting circuit includes an optical tap and photodiode coupled to the input and output of said first amplifier stage, and said second gain detecting circuit includes said position indicating circuit, and an optical tap and photodiode coupled to the output of the second amplifier stage.

27. The variable gain optical amplifier described in claim 26, wherein said second gain detecting circuit is connected to the output of the optical tap and photodiode connected to the input of the first amplifier stage.

28. The variable gain optical amplifier described in claim 26, wherein said second gain connecting circuit is connected to the output of the optical tap and photodiode connected to the output of the first amplifier stage.

29. A method of controlling a variable gain optical amplifier of the type having an amplifier stage connected to a power source, and a variable optical attenuator having an input connected to an output of the amplifier stage and a movable controller that changes a signal gain when moved, comprising the steps of:

monitoring the strength of an incoming signal transmitted to an input of said amplifier stage;

monitoring the strength of an attenuated, amplified signal transmitted from an output of the variable optical attenuator in accordance with a predetermined relationship between a position of said movable controller and signal attenuation, and

maintaining a predetermined gain setpoint by varying the amount of power conducted to the amplifier stage from said source and/or varying the position of the movable controller in response to changes in the strength of said input and output signals.

30. The method of controlling a variable gain optical amplifier as described in claim 29, further including the step of monitoring the strength of an amplified signal transmitted from an output of said amplifier stage.

31. The method of controlling a variable gain optical amplifier as described in claim 29, wherein said amplifier includes a second amplifier stage connected to a power source, and having an input connected to the output of the variable optical attenuator, and wherein said predetermined gain setpoint is maintained by varying the amount of power conducted to the second amplifier stage.

32. The method of controlling a variable gain optical amplifier as described in claim 31, further comprising the step of monitoring the strength of an amplified signal transmitted from an output of the second amplifier stage.

33. The method of controlling a variable gain optical amplifier as described in claim 29, further comprising the step of converting said predetermined relationship into a look-up table.

34. The method of controlling a variable gain optical amplifier as described in claim 29, further comprising the step of converting said predetermined relationship into a formula.